DRAFT

Environmental Benefits of EERE Technologies and Deployments – Health Impacts and GIS Considerations

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NAS Benefits Matrix is Used to Categorize and Identify Benefits of R&D

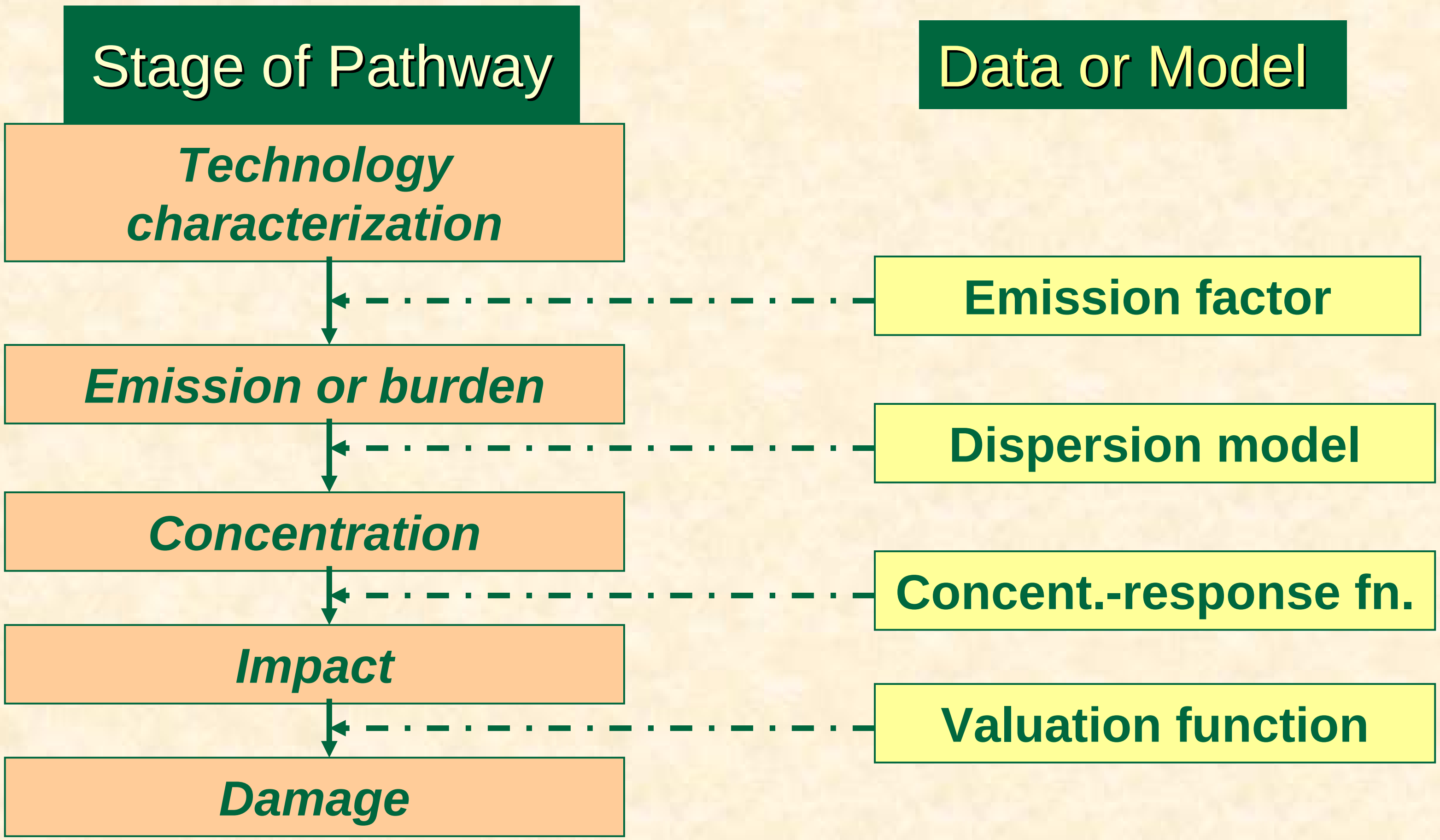
Filling in the "Environmental Row" of the Matrix is the Priority of this Task

	Past	Future	
	Realized	**Projected**	**Option Cases**
Economic			
Environmental			
Security			
Knowledge			

Emissions Lead to Environmental and Health Impacts

Emissions	Mortality	Morbidity	Materials	Crops/ Forests	Aquatic/ Fisheries
Primary Air Particulates SO_2 NO_x GHG					
Secondary Air					
Water & Solids					

Impact Pathway/Damage Function Methodology Used to Estimate Impacts and Damages



Benefits of R&D: Reduced Environmental and Health Impacts Due to Deployment of Better Technologies

GOAL:

- Develop capability to estimate health-related benefits of EERE programs due to reduced emissions

APPROACH:

- Review recent literature on health impacts of fine particles, ozone, and mercury and on their economic value
- Interact with EERE's other analysis groups to address GIS and other considerations
- Develop tools to use EPA models that estimate health impacts and their associated economic value
- Incorporate updated literature
- Develop tools to link EPA models with models used by EERE, such as NEMS and MARKAL

Objectives of Task are to Work with Other Analysis Tasks to Develop Estimates of Benefits of EERE Technologies and Deployments:

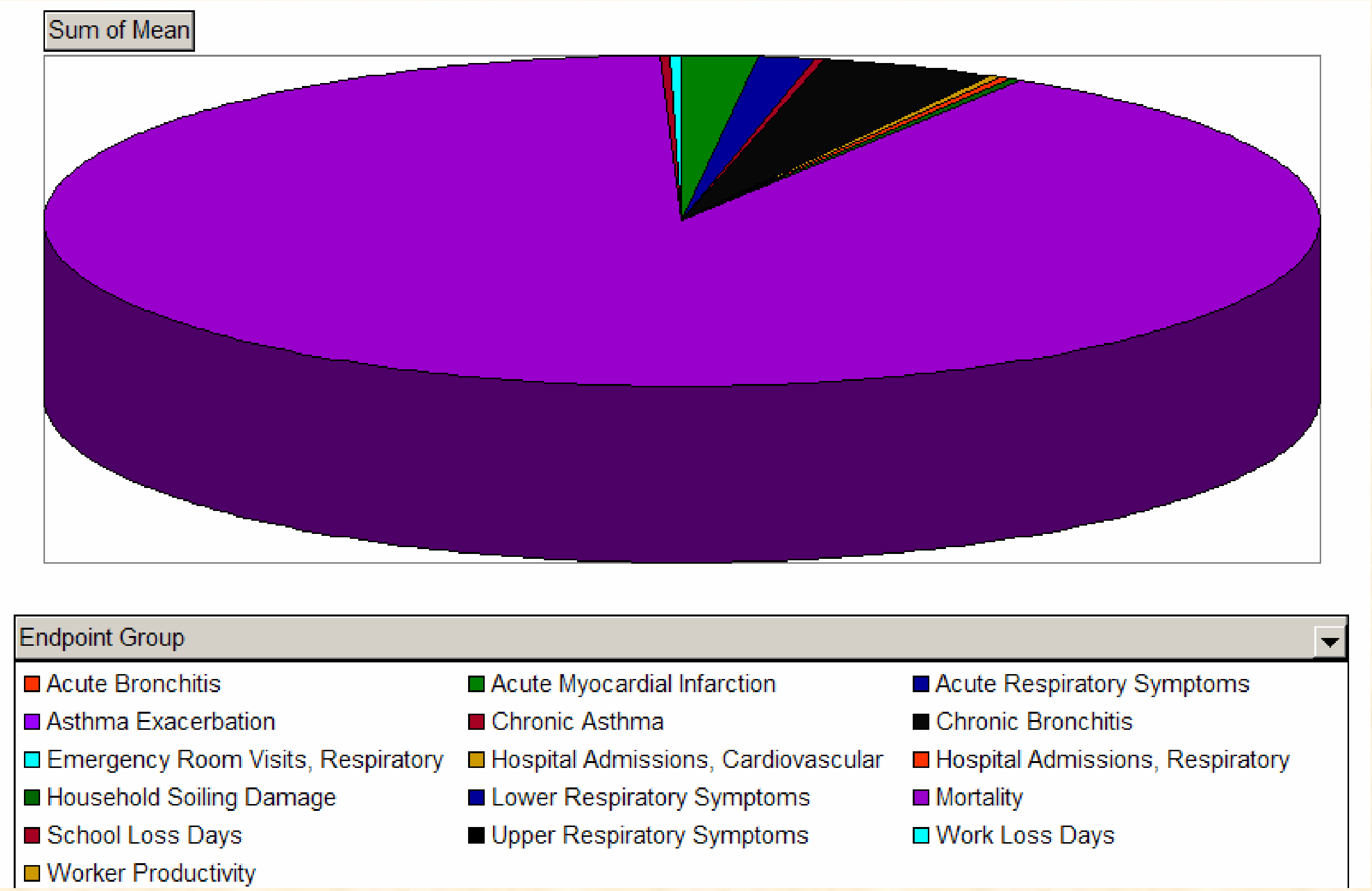
- Estimates of cost savings from improved energy efficient and renewable energy technologies
- Projected improvement in air-quality attainment status
- Estimates of reduced health impacts and their economic benefits, that result from reduced emissions and associated concentrations

Tests with Beta Version of EPA's BenMAP Suggest it Could be Used, Together with other Software Tools

- EERE-related technologies and deployments represented in NEMS, MARKEL, etc. as separate "modules," or in off-line models
- Model outputs provide forecasts of market penetration and use of different technologies
- Module to be developed – coefficients to estimate emissions associated with different technologies
- Estimates of emissions from these calculations
- Transfer functions or response surfaces, to be developed, and used to "translate" changes in emissions, relative to a reference case, to changes in concentrations of pollutants
- Changes in concentrations are an input to BenMAP model
- Health impacts and associated economic value calculated

A 1% Decrease in Concentration of $PM_{2.5}$ and Ozone Resulted in Reduced Health Effects -- Benefits about $16 billion/yr

Most of the value from reduction in expected mortality



Our Test Results Were “Reasonable” in Comparison with EPA’s Results for the Clean Skies Initiative

- We used arbitrary 1% reduction in concentration in each county
- For its Clean Skies initiative, EPA calculated reductions in concentrations (of $PM_{2.5}$ for example) that range from less than 1% to as much as 25% at the extreme tails of the distribution, at different places in the U.S. – average for the U.S. was about 10%
- Our estimate of $16 billion/yr benefit from the 1% reduction, compares with EPA’s $113/yr benefit from the ~10% reduction in its Clean Skies scenario
- Our estimate of reduced mortality of 1,400 from the 1% reduction in concentration compares with EPA’s estimate of 14,000 from the ~10% reduction in concentration

Need to Address Different Geographic Scales of the Different Models

- Situation: Aggregate regionalization of NEMS and MARKAL is in contrast to disaggregate geographic representation in models that estimate health impacts, such as BenMAP
  - 13 electric power regions in NEMS, for example
  - Wind model more detailed spatial break-down
  - 3142 counties in the U.S., in BenMAP (or even a greater number of air-quality grids that are based on air-quality monitors)
- Need: "Allocation functions" for allocating regional totals to individual areas within each region, for both stationary and mobile sources of emissions
- Approach: Anticipate a prorated allocation of emissions to smaller areas, based on:
  - Relative projected populations (for mobile sources)
  - Current or projected sites, attributes, and generation of major stationary sources
  - Other geographically-detailed information and projections
  - Maintain consistency with regional totals

GIS Considerations Need to be Addressed Concerning the Dispersion of Pollutants

- Situation: Emissions are dispersed to other places; they also undergo chemical transformations → emissions:concentrations not a 1:1 relationship
- Need: Transfer functions or response surfaces to “translate” changes in emissions to changes in concentrations
- Approach: Plan to use forthcoming EPA transfer functions based on detailed air pollutant transformation and dispersion models

After these GIS Considerations are Addressed, we will have a Suite of Tools that can be Used to Estimate

- Air-quality attainment/non-attainment status of counties
- Environmental health impacts and benefits of reduced emissions
- Economic benefits of reduced emissions, associated with EERE technologies
- Reduced costs of meeting standards (calculated directly from integrated energy models)